



# Design Thinking

The Power and Purpose of Light  
Richard Fleming, Architect

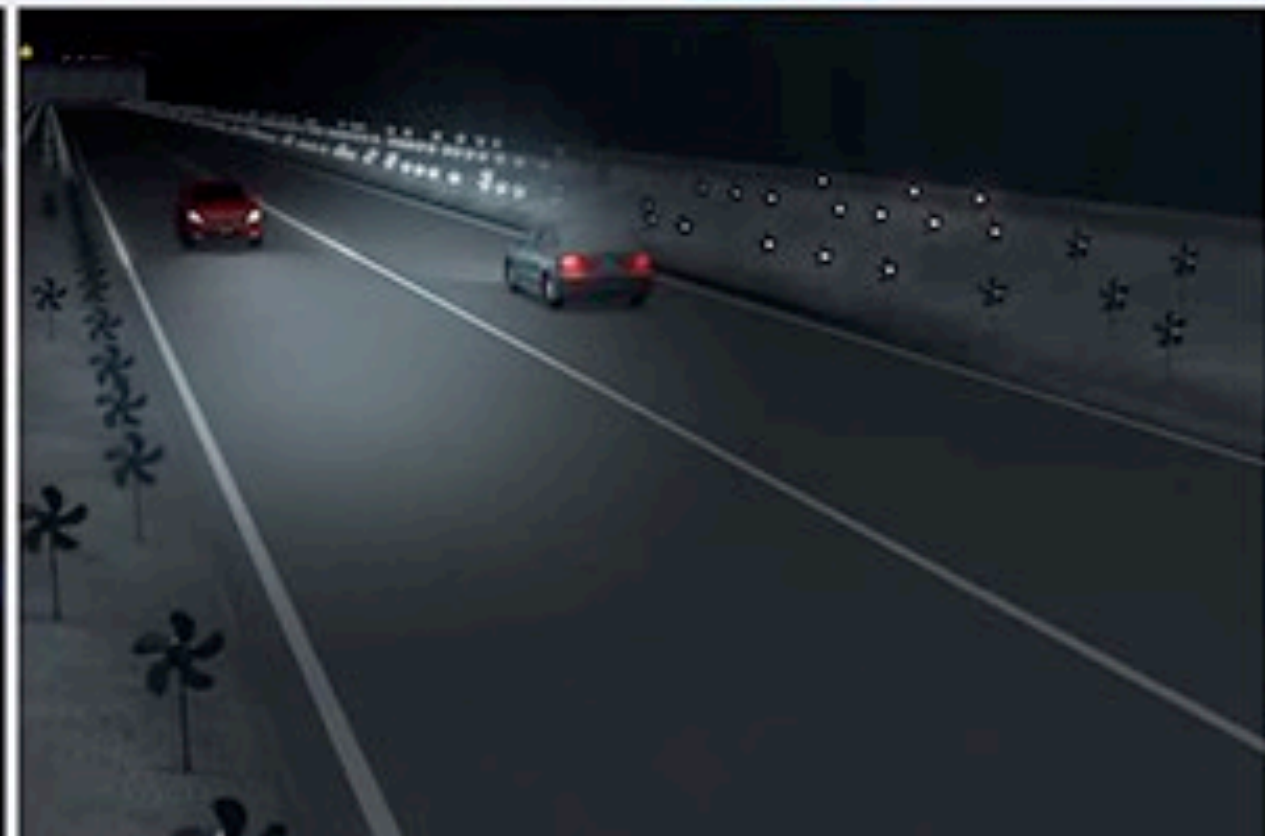


# Design Lighting

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- The Power and Purpose of Light
- Emotional Experience and Environments we interact with
- Natural Light - Humans, Animals and Plants
- Opportunities and Constraints
- Enlightening People, Profession, Practice and Pieces of Work





## Lighting Design/Opportunities - Netherlands

The moving cars wind activates fans to illuminate lights along road & moving cars activate motion sensors





Lighting Design/Opportunities - Netherlands

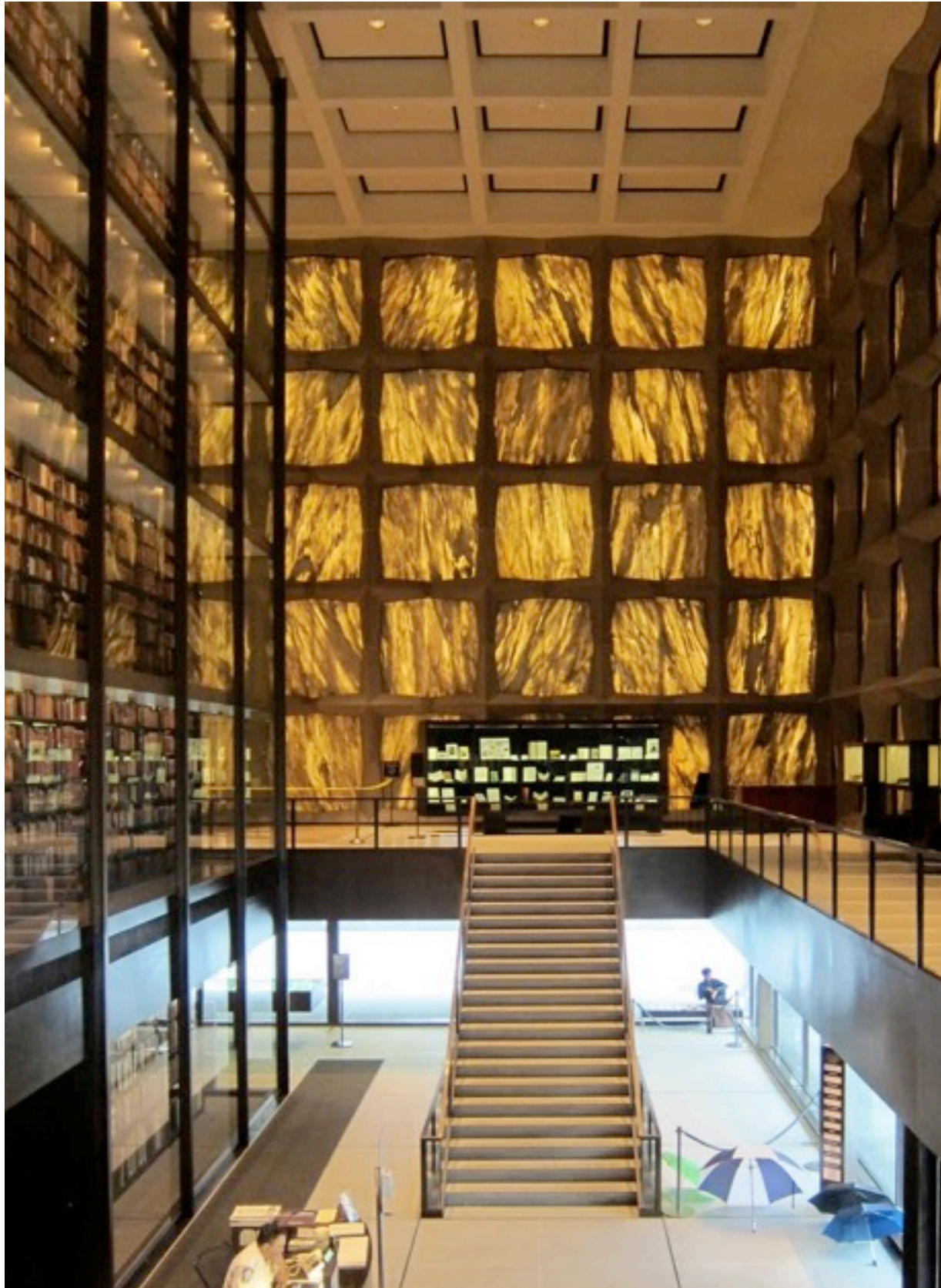
Dynamic paint glows from sun in snowflake shapes when ambient temperatures drop to a certain level





Lighting Design/Opportunities - During a black out, Brazilian mechanic Moser invented a way to light his workshop/home during the day without relying on electricity by using plastic bottles filled with water, bleach and the principles of refraction. (40-60 w bulb) Now in 1 million homes and 16 countries





Design Lighting - Yale University's Beinecke Rare Book Library has no windows because the walls are made of translucent marble panels that can keep the books protected from the sun. (G. Bunshaft 1963)



Denver:  
300 Days  
of  
Sunshine



Design Thinking : Incorporate 300 days of sunshine per year & innovate a translucent roof & clearstories  
Denver International Airport Denver, Colorado, USA (Fentress 1995)





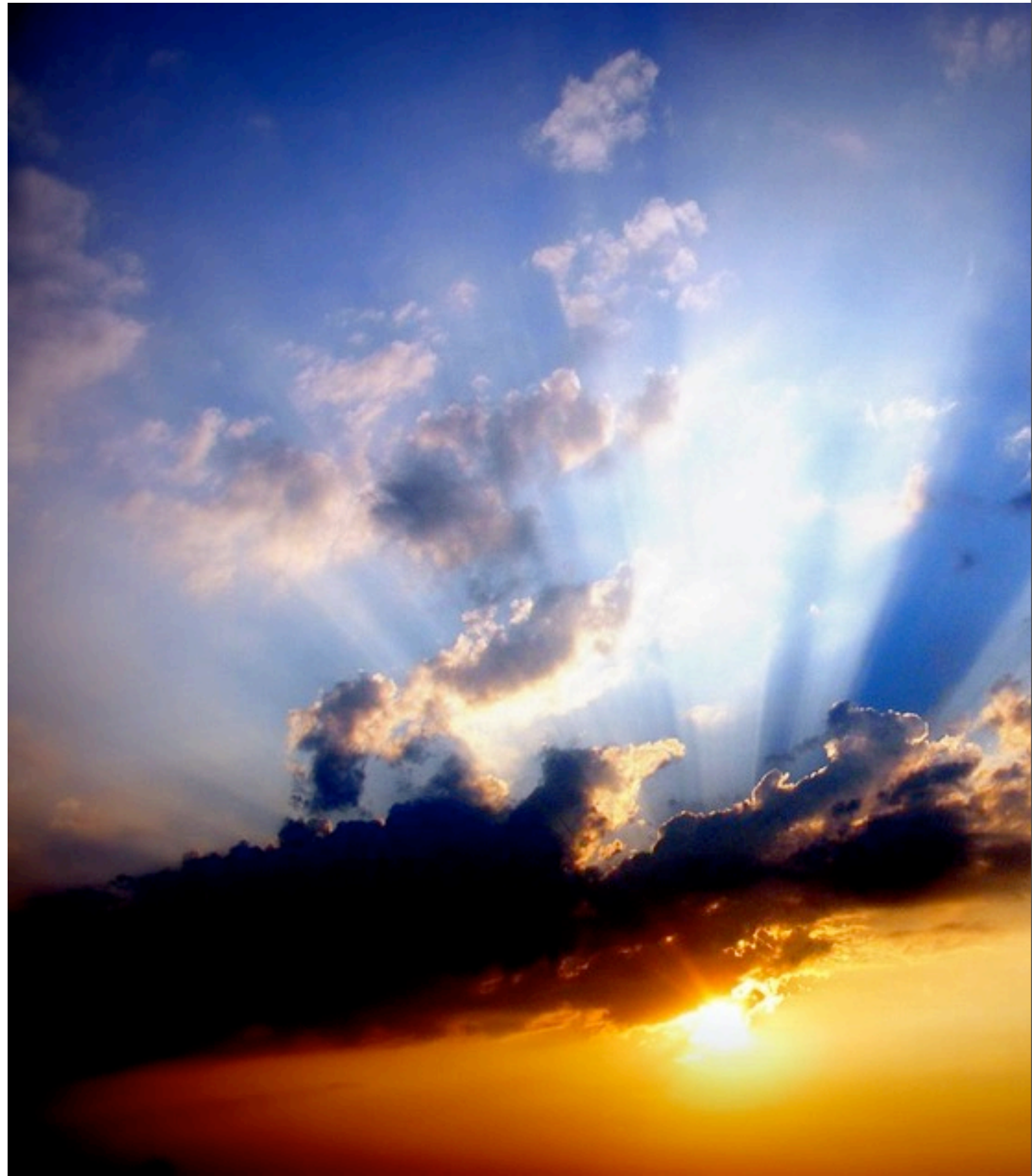
Design Thinking : Lighting Design/Opportunities - Natural Daylighting - Reflection  
Circle Yachts, Blohm + Voss ( Zaha Hadid, Architects )





**Radiometer.**

**What can  
this rotating  
device  
demonstrate  
about light?**



“Light Pressure” Thermal Creep Heat in form of light, dark warms up white side spins to cool dark side.  
Crookes Radiometer



Can the Color of Light make you Happy?





# Can the **Color** of Light make you Happy?

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- Color Therapy Eyewear - “Color can do wonderful things for our moods. Just think about it. A room painted in a particular color can incite feelings of calm, energy, sensuality, or irritation – it’s all up to our senses. So when you want the benefits of color to help you reach a higher level of wellness, why not try seeing the world in your own shade with our color therapy glasses.” - Manufacturer of Color Lenses

**Violet:** Beauty, Inspiration, creativity, calm nerves and reduce irritation.

**Indigo:** Understanding, imagination, serenity, accurate perception and strong deep sleep.

**Blue:** Relaxation of the mind, peace, calmness, creativity, clear communication, and vitality.

**Green:** Hope, self control, calmness, stress reduction, peace, and balance.

**Yellow:** Optimism, mental clarity, and concentration.

**Orange:** Cheerfulness, resourcefulness, enjoyable relationships, and social confidence.

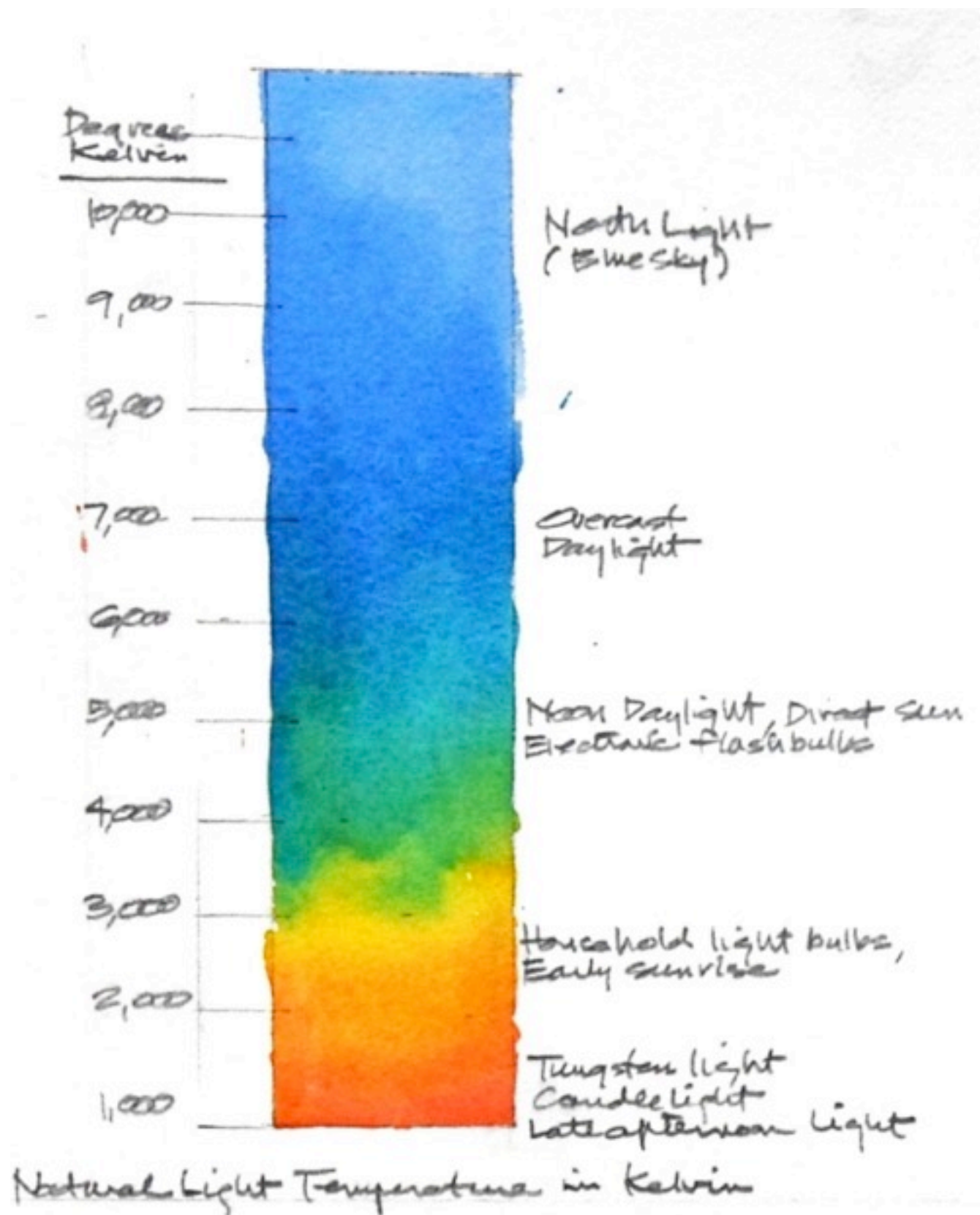
**Red:** Pioneering spirit, courage, strength, a sense of power, vitality, and overcoming negativity.

**Aqua:** Openness, soothing feeling, sensitivity, relaxation, and confidence.

**Magenta:** Relaxing, gentle, soothing, and balanced emotions.

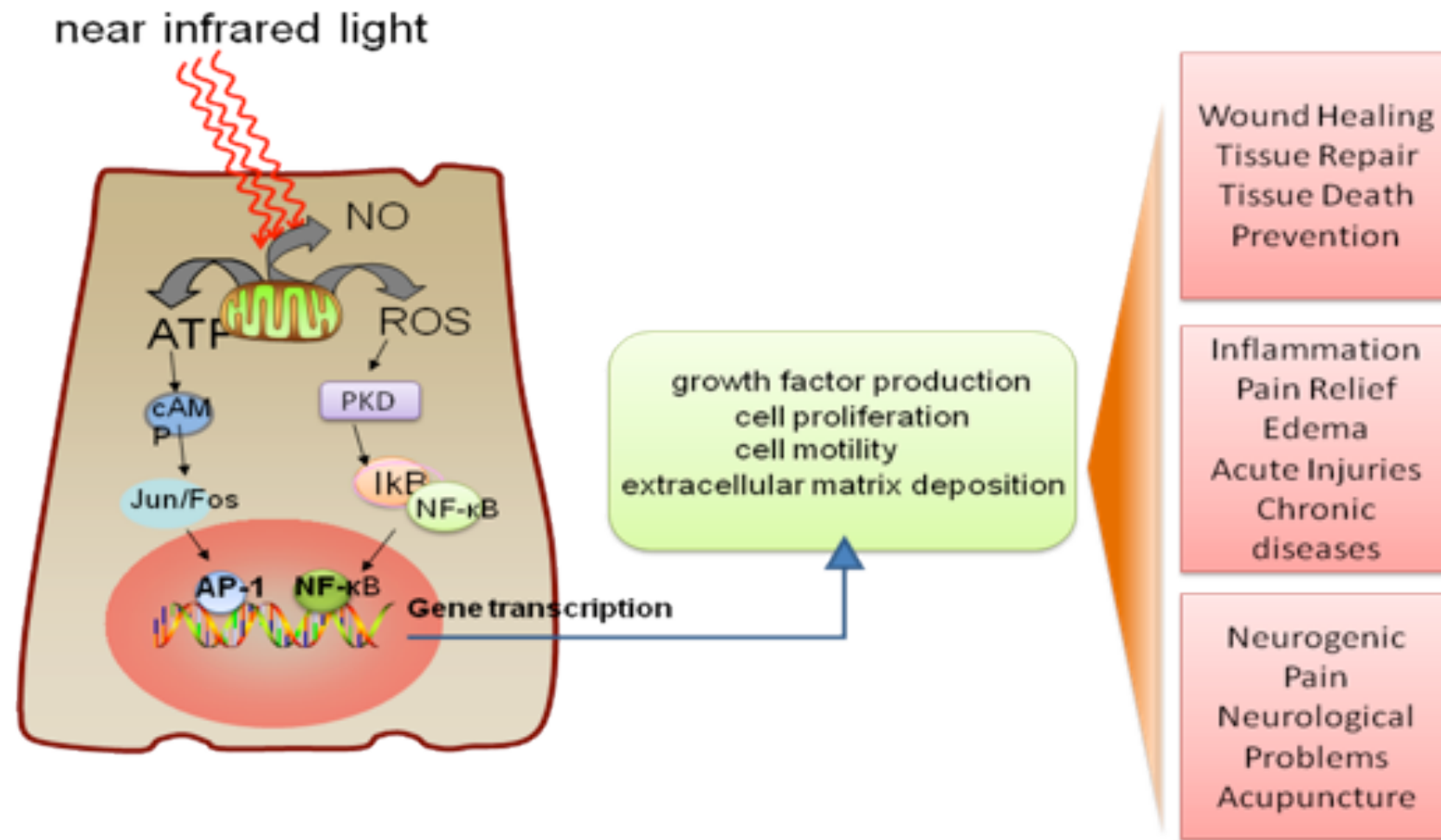






Lighting Design/Opportunities - Wearing colored glasses alter human emotions





Medicine of Light ?

Lighting Design



# Design Lighting

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## • THERAPEUTIC EFFECTS

Increases blood capillary circulation and vascular activity by promoting improvement in the metabolism of nitric oxide (NO). This facilitates improved regulation of vasodilation and leads to the formation of new capillaries - this in turn provides additional oxygen and nutrients to accelerate natural tissue healing processes and eventually evokes a cascade of beneficial biochemical processes.

Stimulates synthesis of adenosine tri-phosphate (ATP)—an immediate energy source for muscle contraction and essential in the metabolism of all cellular processes and sustaining living systems

Relaxes muscles, reduces nerve excitability and stimulates nerve transmission

Reduces scar tissue and stimulates wound healing

Increases lymphatic system activity and relieves edema and discomfort associated with swelling

Stimulates acupuncture points and immune response

Stimulates production of collagen—the most important component of wound healing

Increases phagocytosis - the body's natural process to scavenge dead and degenerated cells and is important to the infection control process required for healing

Increases RNA/DNA synthesis - this stimulates cellular reproduction and facilitates accelerated replacement of damaged cells

Increases production of endorphins and enkephalins from the brain - promoting pain reduction and mood elevation

Stimulates production of adrenals— which facilitate long term pain relief and resilience to stress

Reduces inflammation and swelling in chronic conditions of arthritis, bursitis, and tendonitis

Stimulates fibroblastic activity - promoting repair of connective tissue and formation of collagen fibers

Stimulates tissue granulation and connective tissue formation - an important process in the healing of wounds, ulcers and inflamed tissues





# The end of night


“An eternal electric day is creeping across the globe, but our brains and bodies cannot cope in a world without darkness”



“In 2012, he advised NASA engineers to change the light bulbs on the International Space Station to a type of LED that can display blue shifted light during the ‘day’, when the crew is working, and red-shifted light when they need to rest.” Steven W Lockley, a Harvard neuroscientist, recommends altering the light to improve matters.” *by [Rebecca Boyle](#)*



THE COLOR OF 7

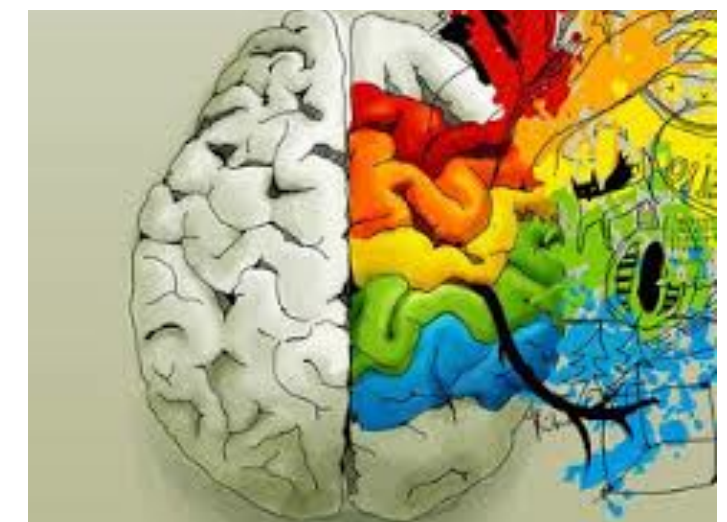


UNDERSTANDING THE PHENOMENON OF  
**SYNESTHESIA**

Synesthesia is not widely known. It is a rare phenomenon that occurs in only about **1% of the population**. It is not a disorder or a disability; rather, it is sometimes called an **"extra ability."** A person with synesthesia basically has two different perceptions of the same stimulus. In other words, they may hear color, see sounds, or taste a physical touch.

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**WHAT IS SYNESTHESIA?**



Can we hear color ?

Synesthesia - syn·es·the·sia / sinəs'THēZHə






Lighting Design/Opportunities - Lighting Motion and Play  
Obscure Digital. Com





Lighting Design/Opportunities - Lighting Design Projections and Music



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- The Power & Purpose of Light
  - Inventory - Opportunities & Constraints
  - Feel, Smell, Touch, Taste & Love
  - Humans, Animals & Plants
  - Innovate & Iterate

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Design Thinking



# Advantages of Effective Daylighting

1. A proper daylighting plan can reduce energy costs with little or no additional investment in systems.
2. A proper daylighting plan can reduce electricity costs.
3. A proper daylighting plan can reduce HVAC (heating, ventilation, and air conditioning) costs.
4. Energy savings range from 15 to 40 percent (facilitiesnet.com)
5. People have a natural attraction and need for daylight.
6. Proper daylight can prevent eyestrain in the workplace or school building.
7. Proper daylight can help increase concentration and maintain focus on the task at hand.
8. While there can be some upfront additional

costs, the overall long-term savings will typically make up for any initial dollars spent on daylighting.

9. Can have a direct impact on well-being, productivity, and overall sense of satisfaction.
10. Creates a more calm and productive environment because it connects people to the outdoors.
11. According to a study done by the Sacramento Municipal Utility District, people perform 10 to 25 percent better on tests of mental function and memory recall when they work in a room with daylight and a view, compared to those with no daylight or view.
12. People with a view and exposure to natural light are less likely to report negative health symptoms, according to the Sacramento Municipal Utility District.
13. The Heschong Mahone Group, Inc., an organization that provides professional consulting services in the field of energy efficiency, found that office workers perform 6

to 12 percent faster when their indoor work environment offers exposure to daylight.

Source: <http://h-m-g.com/projects/daylighting/projects-pier.htm>

14. According to a daylighting and work performance study by the California Energy Commission, exposure to daylight was consistently linked to a higher level of concentration and better short-term memory recall.
15. The study by California Energy Commission also concluded that students in classrooms with the highest levels of daylight performed 7 to 18 percent higher on standardized tests.
16. Students in classrooms with the highest levels of daylight were found to progress 20 percent faster on math tests and 26 percent faster on reading tests over the course of one year, according to the Heschong Mahone Group.  
Source: <http://h-m-g.com/projects/>

[daylighting/projects-pier.htm](http://h-m-g.com/projects/daylighting/projects-pier.htm)

17. A positive correlation has been made between the number of hours of useful daylight and retail sales, according to two separate studies performed by the Heschong Mahone Group and the California Energy Commission.  
Source: <http://h-m-g.com/projects/daylighting/projects-pier.htm>
18. Daylight is an effective stimulant to the human visual system and human circadian system.
19. Throughout the day, the variation in the light spectrum of natural daylight is unmatched by any constructed light source. The variation of the natural light spectrum positively “affects the performance of chromatic tasks, where the perception of color is an inherent part of the task”, according to L.G. Williams, author of Perception and Psychophysics.
20. Windows that provide a view as well as daylight can reduce stress.